

THE ROLE OF INDIGENOUS  
3-DIMENSIONAL TITANIUM PLATING SYSTEM  
IN MANDIBULAR FRACTURES

*A Dissertation submitted to  
The Tamil Nadu Dr. M.G.R Medical University*



*In Partial fulfillment of the requirement  
for the degree of*

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BRANCH - I  
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## DECLARATION

I, **Dr.M.ARULMOZHI**, do hereby declare that the dissertation titled “**THE ROLE OF INDIGENOUS 3-DIMENSIONAL TITANIUM PLATING SYSTEM IN MANDIBULAR FRACTURES**” was done in the department of Oral and Maxillofacial Surgery, Tamil Nadu Govt. Dental College and Hospital, Chennai-3. I have utilized the facilities provided in the Government Dental College for the study in partial fulfillment of the requirements for the degree of Master of Dental Surgery in the specialty of Oral and Maxillofacial Surgery (Branch I) during the course period 2007-2010 under the conceptualization and guidance of my dissertation guide, **Prof. Dr.G.Uma Maheswari**.

I declare that no part of the dissertation will be utilized for gaining financial assistance for research or other promotions without obtaining prior permission from the Tamil Nadu Government Dental College & Hospital.

I also declare that no part of this work will be published either in the print or electronic media concept with those who have been actively involved in this dissertation work and I firmly affirm that the right to preserve or publish this work rests solely with the prior permission of the Principal, Tamil Nadu Govt. Dental College & Hospital, Chennai -03, but with the vested right that I shall be cited as the authorized.

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*Signature of the Guide*

*Signature of Head of the Department*

*Signature of the Head of the Institute*

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I dedicate this study to my parents and Grand parents.

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# INTRODUCTION

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## **The Role of Indigenous 3 – Dimensional Titanium plating system in Mandibular Fractures.**

### **Introduction:**

Mandible fracture is the Commonly occurring fractures in the facial skeleton which inturn causes functional and esthetic disfigurement. Which needs early intervention for better post treatment results.

Mandible fractures, may be simple, compound or complex fractures. Any kind of fractures needs the anatomical reduction and bringing the dentate fragment into its previous occlusion.

Sometimes it may leads to a airway obstruction due to the bilateral parasymphysis fractures of the mandible which inturn needs a immediate reduction and fixation in the casualty.

The aim of the maxillofacial trauma treatment is the restoration of anatomic form and function with particular care to re-establish the occlusion traditionally this has been achieved by immobilizing the jaws using the teeth. Using different methods of direct or indirect interdental wiring, the teeth are placed into normal occlusion and immobilized in that position by IMF, the bone fragments being indirectly reduced.

Through the decades various plate and screw osteosynthesis have been introduced like A0 plating system, mini plating system, resorbable plates and screws and 3-Dimensional titanium system, which was introduced by Mustafa Farmand in 1992, has the advantage of providing three dimensional stability to the fractured bony segments.

The primary objectives of any treatment are rapid recovery and function. MMF has withstood the test of time in the management of fractures of mandible along with other conventional methods like skeletal fixation or transosseous wiring. Both have a multitude of disadvantage including disturbances in phonetics, nutritional problem, poor oral hygiene, compromised airway and social inconveniences. It may also be contraindicated or undesirable in medically compromised patients.

To overcome the above disadvantages, internal fixation systems were sought for, fractures in the oral and maxillofacial region.

This study was conducted in the Dept of OMFS. T.N.G.D.C and Hospital to evaluate the efficacy of 3-Dimensional titanium, plates over the 2-Dimensional stainless steel plating system in mandibular fractures.



# **REVIEW OF LITERATURE**

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## REVIEW OF LITERATURE

The oldest record for the treatment of mandibular fractures dates back to 1650 B.C. When an Egyptian Edwin smith papyrus described the examination, diagnosis and treatment of mandibular fractures. The care in which mandible fractures was described was thought to be incurable and therefore not treated. The patient subsequently died.

Around 400 B.C. Hippocrates described direct re-approximation of the fracture segments with the use of circumferential wires (Gold wire). He also advocated wiring of the adjacent teeth with external bandaging to immobilize the fracture. He had the insight to realize the re-approximation and immobilization are paramount in the treatment of mandibular fractures.

Between 25 BC. And 11<sup>th</sup> Century A.D., Surgeons Such as Sushruta (India), celsus (Rome) and Aricenna (Islam) described conservative means of treating jaw fractures. Sushruta advocated the use of manual manipulation, heat and complicated bandaging to treat mandibular fractures where as Avicenna (980 – 1037 A.D.) emphasized the importance at occlusion during the treatment of fractures. This concept is still closely adhered today, nearly 1000 years later.

Guglielmo Salicatti who died around 1280 A.D. is credited with the first description of intermaxillary fixation, where in the teeth of the uninjured jaw are tied to the teeth of the injured jaw. Thoma quotes Bunon (1743) was the first person to use dental prosthesis for the treatment of the fracture jaw. He also mentions the work of choport and desault (1779) who described the effect of the elevator and depressor muscle of the fragments and recognized the complications caused by loose or fractured teeth.

During the 19<sup>th</sup> century, numerous splints were devised, the most popular being that of Gunning (1861) and Bear (1865) This period has been refined to as the “prosthetic era” in fracture management by Thoma. During the period between the World War I and II skeletal fixation developed and become popular.

Rogar- Anderson (1936) modernized the method and produced an appliance by which the fracture fragments could be controlled by means of pins or screws inserted through the skin. In the late 19<sup>th</sup> Century open reduction and internal fixation were used in the treatment of jaw fractures. These methods came into dispute because of high rate of postoperative infection.

Hausmann (1886) was probably the first to describe a method of mandibular fracture stabilization by means of a screw plate system.

Lambotte (1907) had pointed out the possible benefit, such as the provision of stability without the need for further immobilization by using plates and screws.

Lambotte (1913) recommended aluminium, geometrically closed quadrangular plate secured with bone screws at the lower borders of the mandible for the treatment of fractures of the mandibular body via an extra-oral approach. He found that, provided the fragments were properly repositioned, this specially designed, plate osteosynthesis offered sufficient stability without immobilization. However, this method did not gain popularity, may be due to lower biocompatibility of the material.

Danis (1949) was probably the first to design a rigid longitudinal comparison system using a plate screwed to the bone cortex and compared by a device incorporated in the plate. Using this technique, Danis was successful in scanning radiological primary bone healing” in fractures of the forearm bones and of the tibia. He called such healing as “Sonder autogene”.

In 1958, a group of swiss general and orthopaedic surgeons found an association for the study of osteosynthesis with their development of new instrument and methods, which allowed absolute immobilization of bone fragments by means of compression. The problem of stable internal fixation appeared to be almost solved from the technical stand point.

**Schenk (1960)** Succeeded in explaining the clinical success of the technique and also provided histological proof of the success.

**Eugene J.Messer et al (1967)** in his study on dogs compared the use of intraosseous wires, Sherman plate and L-shaped splints. He concluded that wires were inefficient and Sherman plates were bulky although provides adequate stability and L-shaped splint is not strong as the Sherman plate but is moderately effective.

**Rijnko Brony et al (1970)** used wires, Screws and different forms of fingerplates of AO on 40 patients and the results showed that internal fixation showed faster healing and IMF could be omitted.

**Michelet et al (1973)** first published the analysis of 300 cases treated with miniaturized screws plates in the maxillofacial region in which he obtained excellent results. This method allowed monocortical, Subapical and Juxta alveolar fixation without compression and maxillo mandibular fixation.

**Champy et al (1978)** described the technique, which consists of monocortical, juxta - alveolar and sub - apical osteosynthesis, without compression and without IMF, using malleable plate and screws through buccal approach. It was similar to that described by Michelt (1973). They also described ideal line of osteosynthesis. They applied there techniques in 183 cases of mandibular fractures and concluded that it was the most successful and simplest method for mandibular osteosynthesis without IMF and compression.

**Cawood. J.I. (1985)** Compared 50 cases af mandibular fractures treated by small plate osteosynthesis with 50 cases of IMF. According to him, patients who had mini plate fixation regained the ability to open their mouth sooner. He concluded that the plates show considerable advantages over other form of fixation and the rate of recovery of normal jaw function and normal body weight is significantly greater than with MMF.

**Veikko Tuovinen et al (1986 and 1991)** Studied 279 patients with 447 isolated mandibular fractures treated with miniplate fixation using the tension band principle of champy et al. He concluded that semirigid fixation of mandibular fractures with miniplate is a viable treatment option of the management of such injuries.

**Christian Lindquist et al (1986)** gave a report of 45 patients with fractures of mandible treated by rigid internal fixation according to ASIF method and concluded that bone plating is a useful method in the treatment of several different types of mandibular fractures including the severe compound ones.

**W.P.Smith in (1991)** reviewed retrospectively 51 mandibular fractures following miniplate osteosynthesis, which had been delayed beyond the recommended time interval. The incidence of complications was found to be comparable to osteosynthesis performed within 24 hours, stainless steel plates appear as effective in the short term, as those constituted of more expensive alloys.

**Craig Hobar. P (1992)** mentioned about the 3 – Dimensional plating system in his article about methods of rigid fixation.

**Edward Ellis (1993)** found the use of A0 reconstructed bone plate for fracture of mandibular angle to be very predictable and was associated with a low rate of complications on a study conducted on 82 patients.

**M. Farmand (1993)** had been using a new plating system (3 – D fixation) for 3-5 years based on the shape of the plates. Different sizes and thickness were used for different locations and indications. The plates have been used for different areas in craniofacial, orthognathic, reconstructive surgery and in trauma cases. Their clinical results and biomechanical investigations showed a good stability against fractional forces and torsional forces despite. The small size and thickness of the plates.

**Leon A. Assael (1994)** supports the idea that the use of plates and screws to provide rigid internal fixations currently provides the best means of accomplishing the goal of undisturbed healing of unstable factures of the mandibular angle.

**A.M. Fordyce et al (1994)** undertook a retrospective study of isolated mandibular fractures and compared the result of internal fixation by manual reduction without the use of preoperative maxilla mandibular fixation and with preoperative MMF. He concluded that the avoidance of pre operative MMF is more economical and safer. For operation and more comfortable for the patient.

**Joerg M wittenberg (1994)** prospectively evaluated the use of 3 - D plate (8 hole, leibinger, fisher, Irring, Texas) for fixation of mandibular angle fractures in 20 patients. The plate is formed by joining two 4- hole miniplates with interconnecting cross bars. He concluded that early experience with the 3-D plate suggests that it may provide adequate fixation for mandibular angle fractures. The plate can be rapidly applied transorally and the patients allowed to function immediately with a reasonable level of success.

**Rowe and Williams (1994)** have mentioned about 3-Dimensional titanium miniplates for fixation of maxillary fractures.

**Valentino et. Al. (1994)** used Intra oral monocortical miniplating of mandible fractures.

**Nakamura et. Al. (1994)** Complications of miniplate osteosynthesis for mandibular fractures.

**Tate G.S. Ellis, E., and Throelemorton (1994)** Bite forces in patients treated for mandibular angle fractures. Implications for fixation recommendations.

**Choe BH, Kyoung NK, Ho SK; 1995)** Clinical and in vitro evaluation of mandibular angle fracture fixation with the two - mini plates system.

**Mustafa Farmand (1995)** developed a new titanium 3 - D plates system and treated 126 patients with trauma, craniotacial, orthognathic and reconstructive surgeries with them. The concept behind the system was the stability which was achieved mainly by its configuration and not by its thickness or length. He reported the disadvantages and complication rates related to the 3 - Dimensional plates were very low in his study.

**Robert kellman et al (1995)** in his book the Atlas et craniomaxillofacial fixation has shown the various uses of 3-D plates in various sites including orbital floor reconstruction, mid face osteotomies and craniofacial surgeries.

**Ressel S. Bleider H et. Al (1995)** evaluated the use of 3-D standard bone plates for mandibular angle fractures and suggested that the plate configuration does provide adequate fixation for mandibular angle fractures while maintaining osseous vitality in the vicinity of the fracture.

**Schierle et. al (1996)** evaluated the studies of the biomechanical stability of different miniplate configurations for the mandibular angle.

**M. Farmand et. al. (1996)** Experiences with the 3-D miniplate osteosynthesis in mandibular fractures.

**J.Tams et. al. (1997)** did a three - dimensional study of bending and torsion moments for different fracture sites in the mandible on different position of the bite points. It was found that the angle, body and symphysis fractures each have a characteristic load pattern and they play a decisive role in the treatment of mandibular fracture with regard to number and positioning of plates. Angle had relatively high positive bending movements; body has highest torsion movements, symphyisial fractures had negative bending movements and relatively high torsion movements.



**Wittenborg et. al (1997)** Biomechanical evaluation of new fixation devices for mandibular angle fractures.

**Ian R Mathew et.al (1998)** used low vacuum scanning electron microscopy to characterize the appearance of metal particles released from stressed and unstressed Champy miniplates placed in dogs and to study the relationship of the debris to the surrounding tissue. Under SEM examination, the titanium particle has a smooth, polygonal outline. Stainless particles were typically spherical, with numerous projections on the surface. Most particles were 1 to 10 mm in diameter. Tissue response to the particles was variable and appeared to depend on their location.

**Marchena et. Al (1998)** Studied sensory abnormalities associated with mandibular fractures. Their Incidence and natural history.

**Peter ward booth et.al (1999)** in his book, has mentioned about the history and reviews about three - dimensional titanium miniplates.

**Julio Acero et. al (1999)** evaluated the behavior of titanium as a biomaterial using scanning electron microscopy. Their findings suggested a higher development of corrosion in titanium than previously reported.

**Jorg wiltfang et.al (1999)**, investigated in an animal experiment. Peter ward booth et al (1999) in his book, has, mentioned about the history and reviews about 3-dimensional titanium miniplates, possible PIT (Passive Intraosseous Translocation) effect using resorbable PLA/PGA mini plates (Lactosorb, W. Lorenz of FL.USA) following cranio - osteoplasty. He concluded that in growing skull resorbable plates seems to be a promising therapeutic approach.

**Jose C. Moreno et al (2000)** Compared the Complication rate with different types of mandibular fracture treatment, with MMF, 2mm miniplates, 2.5mm A0 plates and 2-7 mm A0 plates. A total of 245 patients with 386 fracture site were retrospectively analyzed. He concluded the occurrence of post-operative complications is fundamentally related to their severity of the fracture rather than to the type of treatment used.

**Ellis. E III, et al (2000)** Compared actual results after open or closed treatment of fractures of the mandibular condylar process.

**Wolfgang Heidemann et.al(2001)** Compared metal/Osseous interface and bone remodeling after insertion of different types of screws and found that the drill free screws were superior to self – tapping screws.

**Meyer et. al (2002)** demonstrated Photo elastic analysis of bone deformation in the region of the mandibular condyle during mastication in the study.

**Haug et. al(2002)** A biomechanical evaluation of Mandibular condyle fracture plating techniques was done.

**Wagner et. al (2001)** A-3 dimensional finite element analysis investigating the biomechanical behavior of the mandible and plate osteosynthesis in cases of fractures of the condylar process (OOO Journal).

**Schon et. Al (2003):** Follow – up of condylar fractures of the mandible of 8 patients at 18 months after trans oral endoscopic – assisted open treatment.

**Gassner R, (2003) et. Al.** Craniomaxillo facial trauma; A 10-year review of 9543 cases with 21,067 injuries.

**Jules Feledy et. al (2004)** Treatment of mandibular Angle fractures with a matrix miniplate a preliminary Report.

**Claude Gunimond et.al (2005)** Used fixation of Mandibular Angle fractures with 2.0 mm 3 - Dimensional curved Angle strut plate. (AJOMS).

**Hidebaru Hibi et.al (2006)** used orthodontic Anchorage system using a locking plate and self - drilling screws.

**Michael Rasse et.al (2007)** Used Resorbable poly (D,L) Lactide plates and screws for osteosynthesis of condylar neck fractures in sheep.

**Hanna Thoren et.al (2008)** advocates the policy of Routine titanium miniplate removal after maxillofacial trauma. The literature provides no definitive answer to the question of whether routine removal of miniplates could or should be indicated, and in what situations. Considering the fairly significant frequency of plate- related complications in general and infection related complications in particular, long term follow-up after treatment is indicated.

**Scott T.Lovald et. Al (2009)** Shared Biomechanical optimization of Bone plates used in Rigid fixation of mandibular fractures.

**Sina Uckan et. Al (2009)** Studied effects of Titanium plate fixation on Mandibular growth in a Rabbit Model. Metallic fixation of a Mandibular body fracture did not cause mandibular asymmetry or restricted mandibular growth in growing rabbits in this relatively small sample.

## ARMAMENTARIUM



# **MATERIALS AND METHODS**

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## **MATERIALS AND METHODS**

### **Advantages of the material**

The preference to use titanium in three-dimensional plating system is mainly due to its following properties.

- Resistance to corrosion
- Excellent bio- compatibility
- Pliability
- No allergic reactions
- Plates will rebound minimally after bending
- Produces artifact – free images on CT and MRI scans.

### **Advantages of the design:**

- Low profile design
- Space between the plate holes permits excellent revascularization.
- Optimal instruments and implant design to avoid complication while handling.
- No stress shielding effect.

### **Advantages of the technique:**

- Minimal tissue dissection near the fracture line
- Fixation Point remains in vicinity on the fracture line.
- Stability of the 3-D plate is achieved by its configuration, not by thickness or length.
- Its stability is due to its Bio geometry.
- Blood supply to the fragments are not disturbed.
- Adjustment are easy because of thin connecting arms of the plate.

**Disadvantages:**

- Breakage of the plate in the arms in about 90% of cases and holes in about 10%
- Fracture of the plate at the lower borders of the mandible.

This study was conducted on 5 patients who reported to the Department of oral and maxillo facial surgery, Tamil Nadu Govt. Dental College and Hospital, Chennai – 3.

**Mandibular fractures:** Were taken up for study are:

- Isolated parasymphysis fractures
- Parasymphysis and Angle fractures
- Isolated body fractures
- Parasymphysis and Body fractures

All the cases were subjected to routine pre – operative evaluation, which includes:

History

Clinical examination

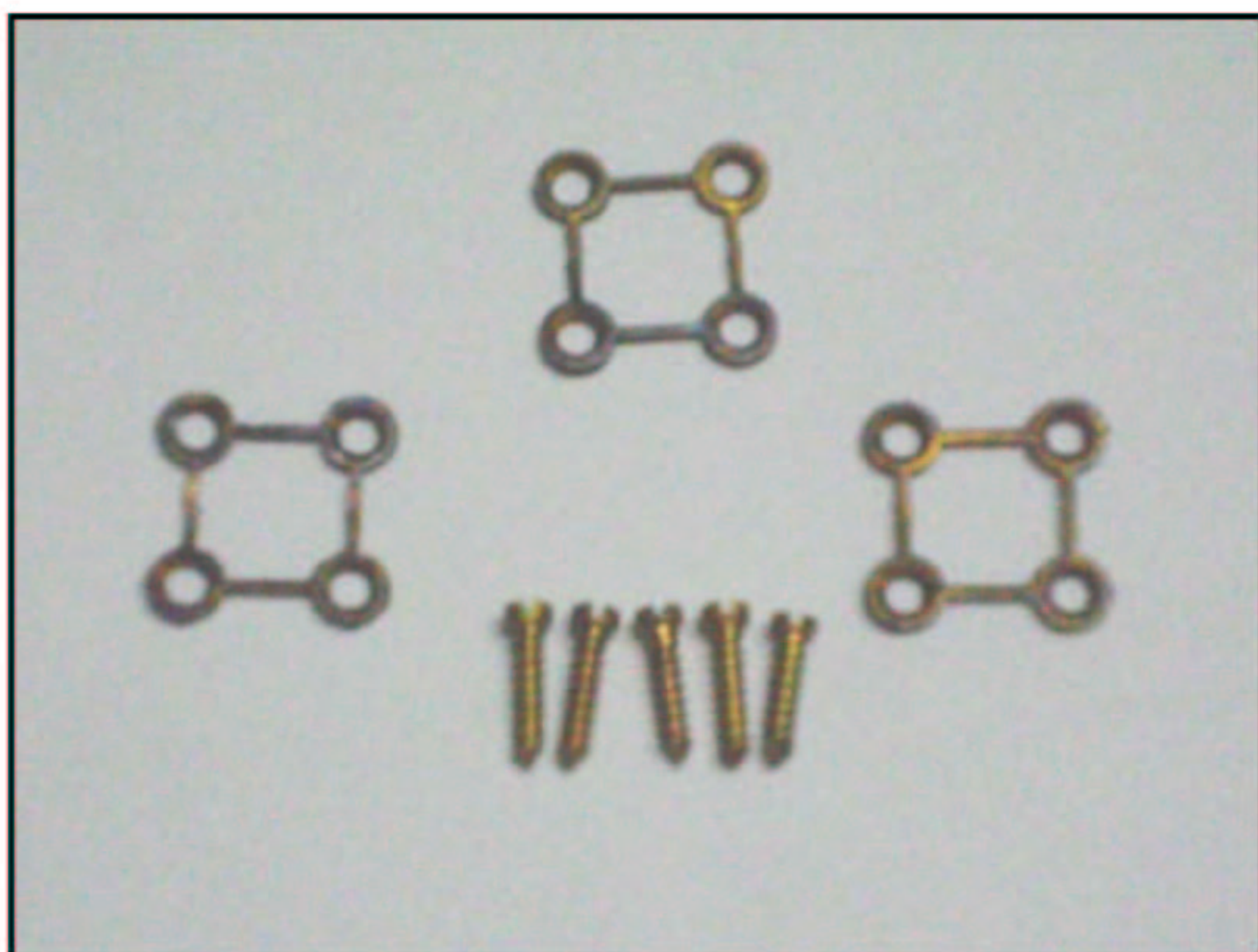
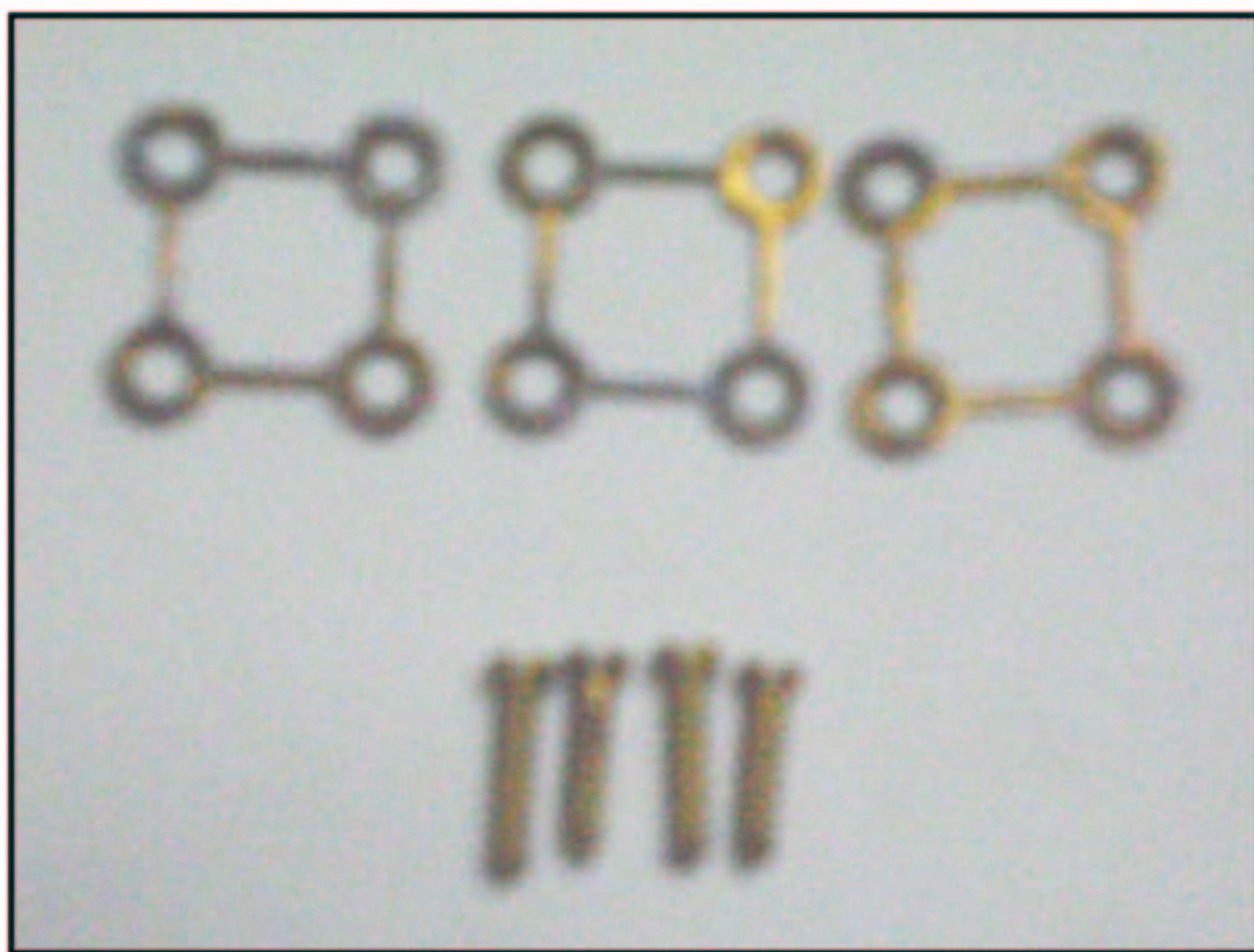
Radiological examination

- Orthopantomogram
- PA view skull
- Lateral oblique view mandible
- Occlusal view of mandible

Routine laboratory investigation were carried out.

Indigenously prepared 3-Dimensional Titanium plates were used to stabilize the fracture segments. After surgical exposure of the fracture sites.







## **Composition of the titanium plates and screws**

Titanium (Grade 2)

N - 0.03%

C - 0.10%

H - 0.015%

Fe - 0.03%

O - 0.25%

Titanium (Rest)%

## **Design of plates:**

4 hole (2x2)

Length - 1.4 cm

Breadth- 1.4 cm

Thickness- 1 mm

Tensile strength - 846 N. (Tested).

## **Screws**

Type - Non compressive Self tapping, Cortical Screws with round head.

Diameter - 2.5 mm

Thread length - 8 mm.

## **Burs**

TC burs 702 & 701

Drill Bits were also used

All the cases were operated under Local Anesthesia. The surgical procedure varied according to the fracture sites either intra or Extra oral approach. Maxillo mandibular fixations were used in all the cases before plating.

## **AIM OF THE STUDY**

Five Mandibular fracture cases were selected for this study to compare the efficacy of 3-Dimensional plating system over the 2-Dimensional stainless steel plates and were post operatively observed and followed up for 3-8 months using clinical and radiographs assessment.

### **The Parameters evaluated were:-**

1. Ease of technique
2. Occulusal stability
3. Inter-incisal mouth opening
4. Signs of infection
5. Trigeminal dysfunction (V3) deficits
6. Functional stability.
7. Removal of plates.

### **Surgical Technique:**

Under Local anesthesia 2 techniques have been used to reduce and fix the plate across the fracture site namely intra oral and extra oral approaches for mandibular fractures.

#### **Intra oral approach** for the following

- Isolated parasymphysis fracture
- Parasymphysis and Angle fracture
- Isolated Body fracture

#### **Extra oral approach**

- Body fracture  
(Sub Mandibular approach)

### **Intra oral Approach:**

Under Local anesthesia using 2% lignocaine with adrenaline A paragingival incision, placed 5mm below the attached gingiva and mucoperiosteal flap raised, the fracture site was exposed and reduced into its anatomical position and brought into an occlusion with Intermaxillary fixation. A4 holes (2x2) 3 - Dimensional plate was adopted and contoured parallel to the fracture site 2.5x8 mm screws were used to fix the plate parallel to the fracture site. Betadine followed by saline irrigation done. Sutures placed with 3-0 chromic catgut (vertical mattress sutures have been placed). The occlusion was checked and intermaxillary fixation was released immediately. Patient given post operative instructions. Antibiotic 4 Analgesics has been prescribed all patients made an uneventful recovery.

### **Extra oral approach (Submandibular approach)**

Under local anesthesia (2% Lignocaine with advenaline) has been given on the right side mandible and extra orally local anesthesia was given near the body region and on the right side lower border of the mandible identified and 2cms below the lower border of the mandible Risdon's Submandibular incision has been placed and layer wise dissection done (skin, superficial fascia, fat, platysma muscle) and then muscle and mandible fracture site exposed fracture identified and reduced and brought into anatomical position. Intra orally occlusion was checked and stabilized with Maxillomandibular fixation.

4 holes plate (2x2) has been adapted and contoured according to the Body of the mandible. 2.5x8 mm screws were used to fix the plate parallel to the fracture site. Betadine followed by saline irrigation done. Layer wise closure done with 3-0 vicryl followed by 6-0 prolene for skin. Patient made an uneventful recovery.

## CASE - 1

Name : **Mr. Baghyaraj**  
Age : 28 yrs  
Sex : Male  
Op no : 039150  
History : alleged H/o RTA.

### On/Examination:

- Swelling over the L Side Angle region
- ® Side Sublingual ecchymosis seen
- Step between the ® side para symphysis region between 32 and 33 teeth region.
- Mobility of the (L) Side Lower jaw was present.
- Occlusion was de-arranged.
- Tenderness was present in the ® Side parasymphysis and (L) Angle region.

### Investigations:

- Radiographs:- OPG Lateral oblique view
- Routine Blood investigations
- Urine Examinations

### Diagnosis:

® Parasymphysis fracture of mandible.  
(L) Angle fracture of mandible.

### Treatment:

Under LA 3-Dimensional Titanium plating for ® parasymphysis 2-dimensional stainless steel plate for (L) Angle region of the mandible by open reduction and Internal fixation.

## CASE - 2

Name : **Linganathan**  
Age : 24 yrs.  
Sex : male  
OP No : 041594  
History : Alleged H/o Interpersonal Violence.

### On examination:

- Occlusion de-arranged
- Mouth opening restricted
- Step seen between the 44 and 45 teeth region
- Swelling & Tenderness present.

### Investigations:

x-ray : OPG (orthopantomograph)  
: IOPA 44 and 45 teeth region.  
: Routine Blood investigations  
: Urine examinations.

### Diagnosis:

® Body fracture of the mandible.

### Treatment:

Open reduction and Internal fixation with 3-D Titanium plate under Local Anesthesia.

### **CASE - 3**

Name : **Raja**  
Age : 24 yrs  
Sex : Male  
OP No : 053320  
History : alleged H/o RTA.

#### **O/Examination:**

- Occlusion de-arranged
- Step between the fracture segment seen between 32 to 44 teeth region.
- Tenderness present.
- Mouth deviation present to left side.

#### **Investigation:**

x-ray : OPG  
              : Rotated PA view mandible  
Routine Blood investigation  
Urine Examination

#### **Diagnosis:**

® Body fracture  
(L) parasymphysis fracture

#### **Treatment:**

Under local Anesthesia Intra oral open reduction and Internal fixation of 3-D Titanium plate was fixed for (L) parasymphysis fracture.  
Extra oral open reduction and internal fixation was used for ® Body fracture of the mandible with 3-D Titanium plate.

## CASE - 4

Name : **Parthiban**  
Age : 29 yrs  
Sex : male  
Op No : 03795  
History : Allege H/o fall.

### On Examination:

- Occlusion de-arranged
- Step between 32 and 33 teeth region seen
- Sublingual ecchymosis seen
- Mouth opening restricted about one finger breadth

### Investigation:

x-ray: Ortho pantomograph (OPG)

Routine Blood investigation

Urine examination

### Diagnosis:

(L) Parasymphysis fracture

### Treatment:

Under local anesthesia open reduction and internal fixation with 3-Dimensional Titanium plate.

## CASE - 5

Name : **Mr. Radhakrishnan**  
Age : 29 yrs  
Sex : male  
Op No : 062156  
History : Alleged H/o fall from Two wheeler on his own.

### On Examination:

- Occlusion de arranged
- Step between 42 and 43 teeth region
- Tenderness over the ® parasymphysis region present.

### Investigation:

X-ray:

OPG

Rotated PA View mandible

Routine Blood investigation

Urine examination

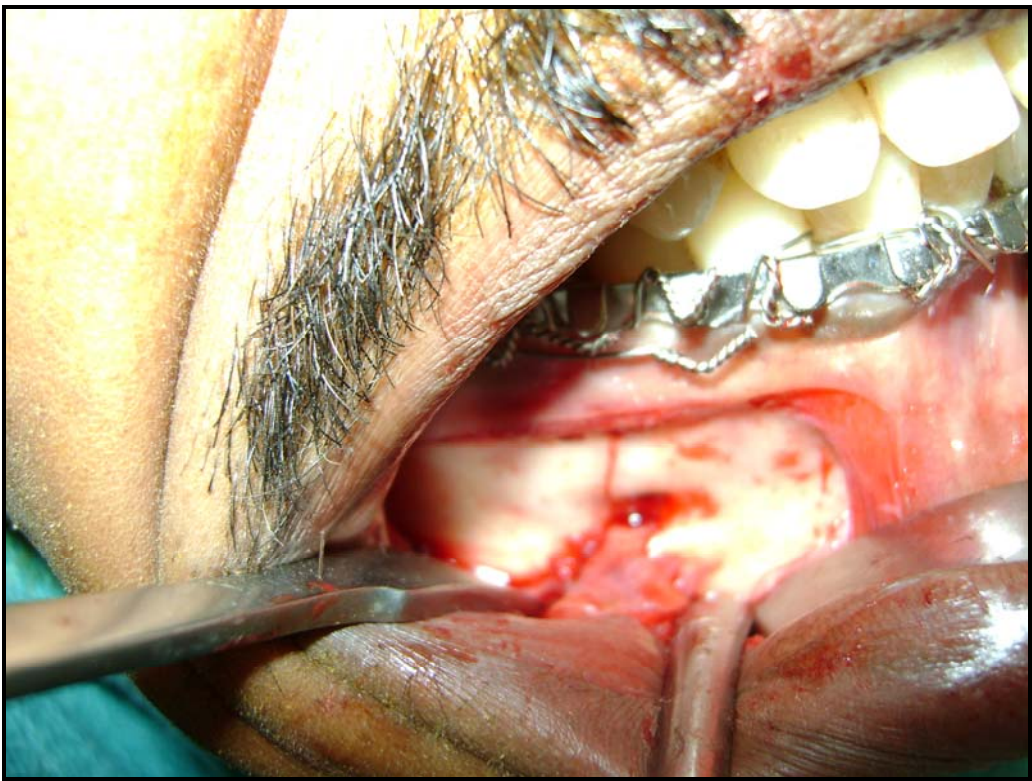
### Diagnosis:

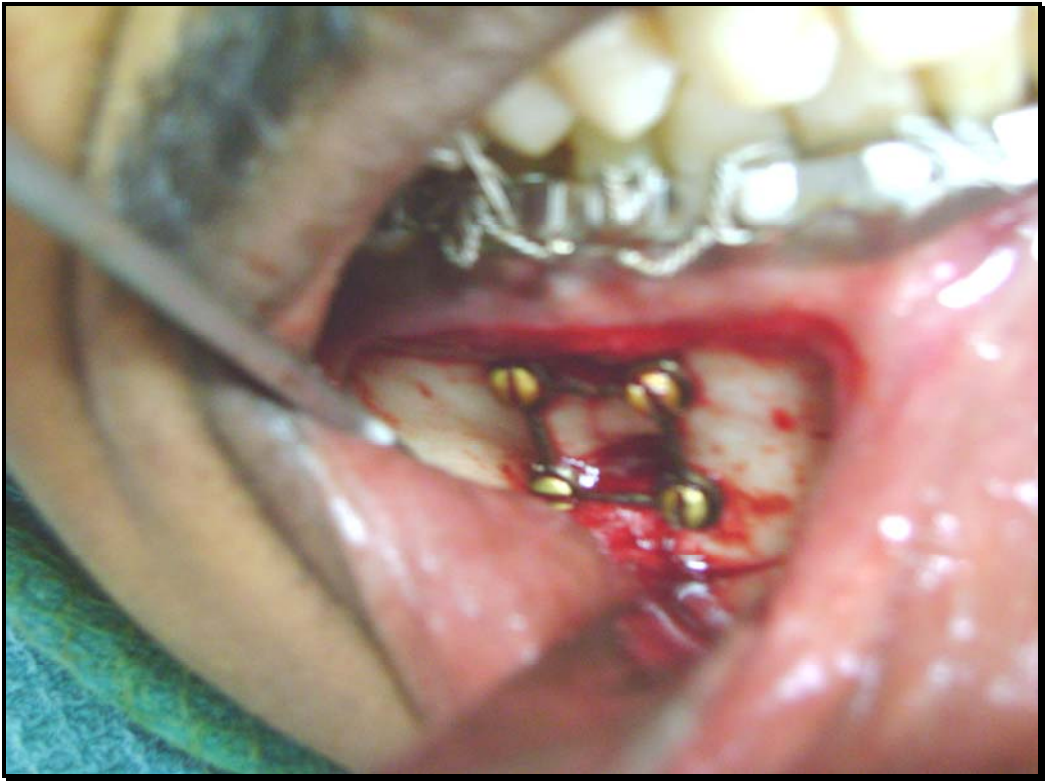
® Parasymphysis fracture

### Treatment:

Under local anesthesia open reduction and Internal fixation with 3-Dimensional Titanium plate.

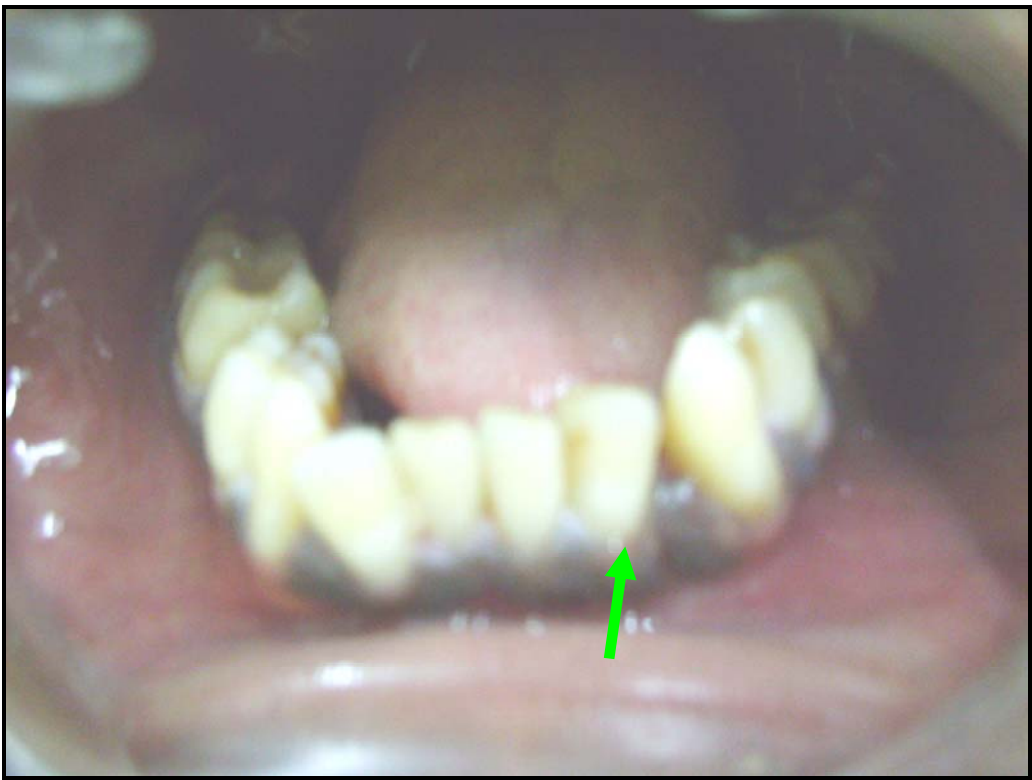
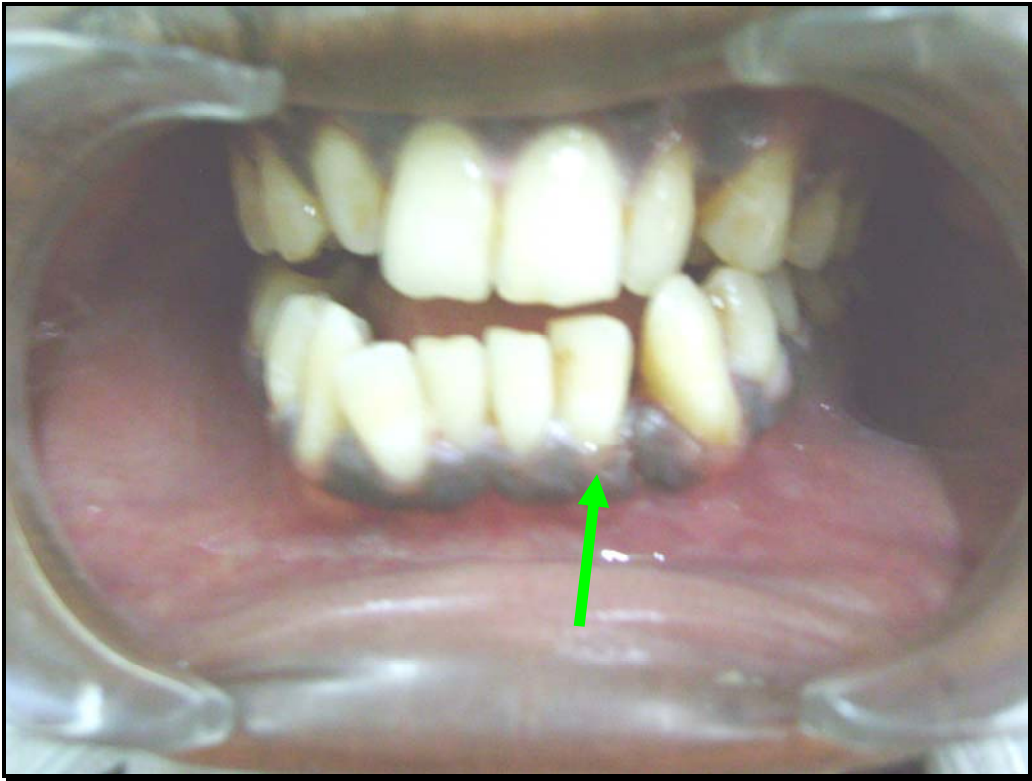


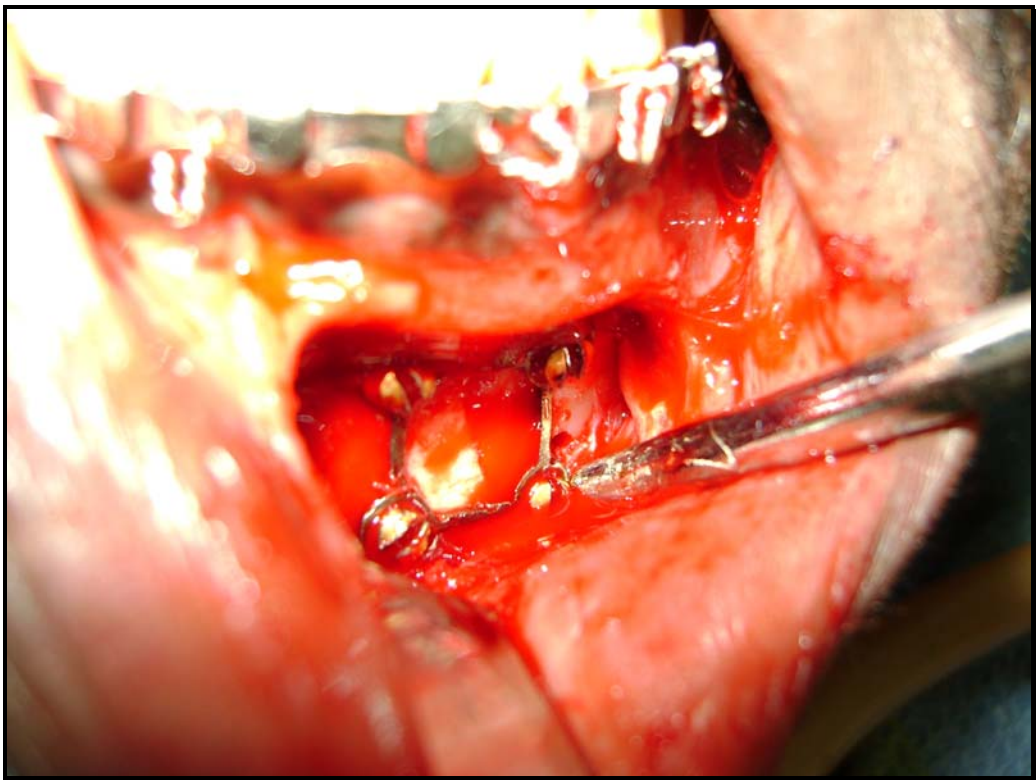










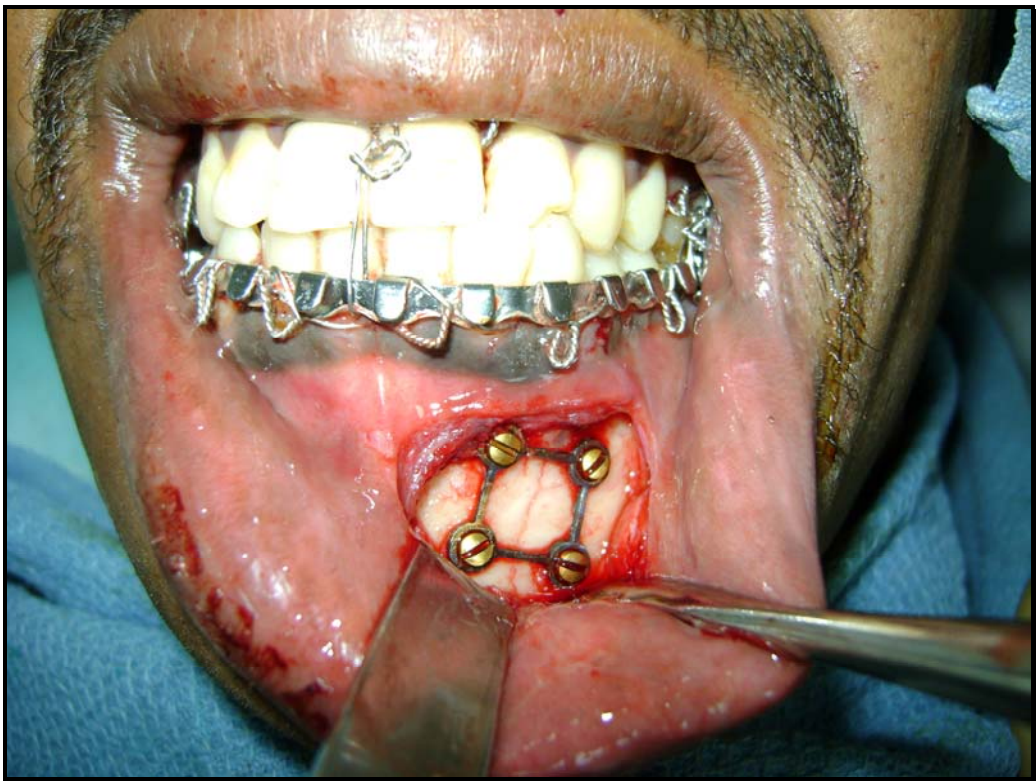
















# **OBSERVATION AND RESULTS**

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## **OBSERVATION AND RESULTS**

The 5 Mandibular fracture cases selected for this study were post-operatively observed and followed up for 3-8 months by clinical examinations and radiographs.

The following parameters were evaluated.

1. Ease of the technique
2. Occlusal stability
3. Interincisal opening width at regular intervals
4. Trigeminal dysfunction (V3) deficits
5. Signs of infection
6. Functional stability
7. Removal of plate.
8. Visual analogue scale Assessment

### **Ease of Technique:**

Since the 3-Dimensional Titanium plate is smaller than the 2-Dimensional stainless steel plate the exposure site is minimal and lesser amount of periosteal stripping were carried out with pliability of connecting arms of the material used. The plates were positioned parallel to the fracture site. The connecting arms of the plate should be positioned rectangular to the fracture line. Tissue dissection only in the vicinity of the planned fracture line.

### **Occlusal stability:**

Even though the Maxillo Mandibular Fixation were released soon after the plate fixation all the patients had occlusion were stable with Angle's class I occlusion.

### **Interincisal mouth opening width**

The interincisal mouth opening were about 30 mms immediately after the surgery and improved to 45 mm post operatively without any problem.

### **Trigeminal deficit (V3)**

There was no injury to the Mandibular branch after surgery in all of five cases prepared.

### **Signs of infection:**

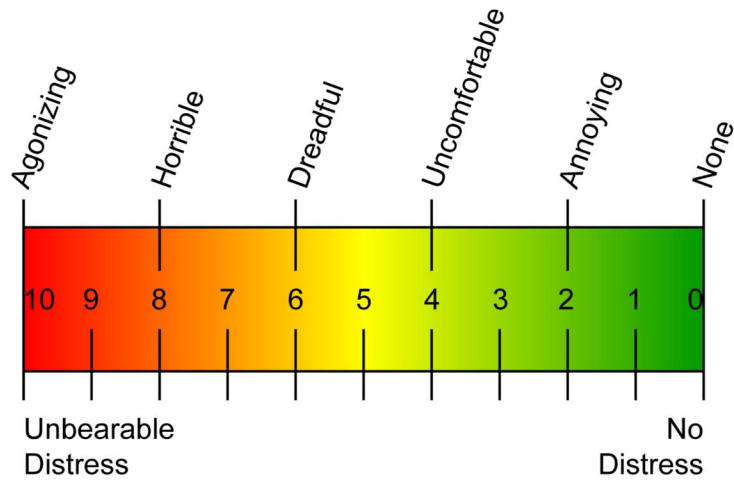
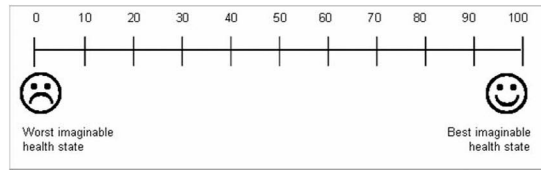
No sign of infection was seen in all of the 5 cases operated.

### **Functional stability:**

In all the five cases of our study, intermaxillary fixation was used temporarily before fixing the plates and were released immediately after surgery and thus enabling the normal functions of the jaws like mouth opening, chewing and speaking. All of our cases demonstrated a good functional stability in the immediate post-operative period without any inter-fragmentary mobility or occlusal disturbance or tenderness. Post operative radiographs also showed no displacement of fragments and normal healing of bone (primary bone healing) was observed.

### **Visual Analogue scale Assessment**

According to this scale it falls on mild category of pain when compared to the stainless steel plating on the patient which results in moderate amount of swelling and pain in the patient who where treated with 2-Dimensional stainless steel plate.



Note the Task Performed

Task Typing

Date \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_



Not hurting  
No discomfort  
No pain



Hurting a whole lot  
Very uncomfortable  
Severe pain



0  
NO HURT



1  
HURTS  
LITTLE BIT



2  
HURTS  
LITTLE MORE



3  
HURTS  
EVEN MORE



4  
HURTS  
WHOLE LOT



5  
HURTS  
WORST









# DISCUSSION

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## DISCUSSION

Traditionally, reduction of fractures that were done with wire osteosynthesis required prolonged IMF with phonetic disturbances, physical discomfort, weight loss to the patients, nutritional problems and long stay in the hospital.

Several author described rigid internal fixation with bone plate osteosynthesis that did away with IMF. Direct rigid fixation plays an important role in the management of maxillofacial trauma and reconstructive surgery.

Rigid fixation has disadvantages like fragment movement while screw tightening, minimal adaptability of fragments with elastics and tension on the bone, resulting in the loosening of screws.

**Hausmann in 1886**, immobilized bone segments with a three - holed plate and since then reports have appeared on the use of miniplates of various designs for both mandibular and maxillary fractures.

**Lambotte in 1913**, recommended geometrically closed quadrangular plates made up of aluminium (Similar to the presently used 3-Dimensional plates) secured with bone screws, for the treatment of fractures of mandibular body.

**Later Michelet et al (1972) and Champy et. al (1975)** who actually worked out theoretical basis of the existing miniplating fixation techniques.

The ideal requirements of Mini plates are

- Bio compatibility
- No shield protection
- Elastic Extension, no irreversible deformation.
- Minimal tissue distraction
- Stability.

**B.G. Miller et. al** used Titanium plates and screws although more expensive than stainless steel are superior because of their better tissue reaction.

**Mustafa Farmand in 1990** developed a new miniplate system made up of Titanium that takes advantage of biogeometry to provide stable fixation and he called it as three -dimensional plating system.

The Concept behind these plates is that, a geometrically closed quadrangular plate secured with bone screws creates stability in all three dimensions.

The principles are further based on the idea that the plate is not positioned along the trajectories but over the weak structure lines. For example, good torsion stability nature of 3-D plates makes it superior to 2-dimensional mini plates. One 3-D plates can be used were to 2-dimensional mini plates are recommended.

Several different sizes, shapes and thickness of the plates are available (**Leibinger system**) depending upon the location of the osteomised and fractured segments but our indigenously prepared 3-D titanium plates that we used for the fracture mandible were 1 mm thick and screws were of 2 mm.

The Biomechanical characteristics of the regular standard 3-D plates prepared by Farmand, easily with-stand fraction forces with a value of 690 N.

The aesthetic and functional acceptability stress shielding and bio compatibility of the titanium are some of the reason to leave these plates in-situ, where thicker plates from other systems need a secondary surgery for removal of the same.

### **Comparison of 3-D plates with 2-D plating System**

The 3-D plating system has various advantages over the popular 2-D plates.

- Stability is achieved by configuration and does not depend on size and material.
- Easy adaptability due to its thin connecting arms.
- 3-D stability is achieved over a definite surface area, of a cube.
- Better resistance to torsional forces particularly in symphysis and condyle than the conventional 2-D plates.
- Optimal resistance to fractional forces.
- Better functional stability.
- Requires lesser tissue dissection than 2D plates because of the smaller size of the plates.
- Better revascularization due to space between the connecting arms of the plate.
- Lesser foreign body due to smaller size and less number of plates in regions like symphysis, parasymphysis and condyle.
- Simpler technique and less operating time
- Variable clinical application.
- It does not necessitate removal of plate like stainless steel plates.
- Excellent Bio compatibility.

It took scientific advances of modern metallurgy to turn the black sand into useful metal commercially pure titanium currently comes in four different grades (1 to 4), 4 being the finest. The most frequently used alloy is Ti A16V4. Grade 2 is commonly used alloy in oral and maxillofacial system.

Titanium in the form of Miniplate, 3D plate, Microplate, Reconstruction plate, Mesh, Lagscrew and implants are all used in oral and maxillofacial surgery. The significance of titanium in the make of implants and its relevance to Osseointegration is well documented in the literature.

The term Osseointegration is itself debated as some author prefer the use of term osseofibrointegration to describe the presence of periodontal like membrane surrounding the loaded implant surface which serves a similar function to that of periodontal ligament which surround a natural tooth.

The concept of osseointegration was described by **Dr. Per Ingvar Branemark** in the early 1960s when optical chambers made out of titanium were implanted into rabbit's tibia to study in-vivo bone marrow function. Once healed these chambers could not be removed because bone had directly grown against titanium frames.

The precise mechanism of osseointegration still remains to be ill – understood although the physiology of bone healing with which it is intimately associated is well documented.

At the molecular level a series of well – orchestrated events are described to occur according to the level of observation.

It is said that at the interface between titanium oxide layer and the environment, water molecules are split into hydroxyl ions. Depending upon where these are in relation to the adjacent titanium ions, either an acidic or basic polarity exists.

Photoelectron spectroscopy has demonstrated that amino acids having a bipolar characteristics can form a strong bond with titanium oxide.

These amino acids builds together to produce PROTEOGLYCAN glue that binds cells together and would appear to form a substructure onto which bone is built.

A very thin layer of proteoglycan glue thus exists between bone and implant surface of osseointegrated implant.

In effect, the body fails to recognize the implant as a foreign body and it becomes incorporated into bone as part of the healing process.

# CONCLUSION

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## CONCLUSION:

The ultimate goal of the modern bone surgery of the mandible aims at a rapid recovery of form and function. Four basic conditions must be met in order to accomplish this goal

1. Anatomic reduction of the bone fragments
2. Functionally stable fixation of fragments
3. Preserving blood supply to the fragments by atraumatic operating technique
4. Early active pain-free fragments mobilization.

**Said by Muller et. al (1969)** in Internal fixation of mandible by Bernd spießl:

Based on these observations, the following conclusions are drawn:

The 3-Dimensional plating system of titanium is

1. It can be used with satisfactory results, especially in cases of unstable fragment. (Comminuted fractures).
- Does not require expensive armamentarium
  - Period of immobilization was not necessary as in other systems
  - Minimal incidence of complications
  - Lesser area of exposure and lesser number of plates for fixations
  - Allows easy revascularization.

In the study conducted in the Department of oral and maxillofacial surgery, Tamilnadu Govt. Dental College and Hospital we have honestly made an attempt to evaluate the efficacy and use of 3-D titanium plates with due consideration to indications, advantages and disadvantages of the technique in the mandible.

The results we obtained suggested that 3-D Titanium plates could be used successfully for fixation of mandible fractures. This system incorporates the advantages of both wires and the conventional 2-D plates. The geometrically closed quadrangular design of the plates results in the reduction of material, superior stability; minimize the disturbance to vascular supply easy adaptation and thereby reducing the operating time with fewer complications. However a detailed study pertaining to particular site with larger samples is warranted before reaching a consensus.



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